Ancient Monuments Laboratory
Report 114/90

AN ASSEMBLAGE MAINLY OF CATTLE METAPODIAL BONES, FROM THE FLOOR AT KING JOHN'S HOUSE, ROMSEY, HAMPSHIRE

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Summary

A group of distal metapodial bones of cattle had been laid, inverted, as part of a post-medieval floor at King John's House, Romsey. There seems to have been some selection of the material by age and sex: nearly all the bones were fused, and probable male bones were found in good numbers. Many of the animals represented had been larger than the medieval and 16th century animals from Southampton. A few bones showed damage on the articular surfaces or in the intercondylar space. Many showed a consistent pattern of rough cutting across the shaft in preparation for their use in the floor, which seems to have been laid to provide a good working surface and not for decorative effect.

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THE MATERIAL

A group of 64 cattle metacarpal bones and 79 metatarsals was presented for study from King John's House, Romsey. Only one bone (a metacarpal) was whole; from all the others the proximal end had been removed. There were a few other cattle bones, and some bones from other domestic species.

The material was excavated in 1977 by a group of amateur archaeologists under the direction of the Test Valley Archaeological Committee. Many, if not all, of these bones had been part of a floor in a downstairs room of an old Romsey building known as King John's House. Parts of this bone floor still remain in place and form a noted feature of the building, now protected beneath a raised wooden surface. By courtesy of the trustees and of the house manager, Mrs. O.M.Sherratt, a viewing was arranged of that part of the floor which is normally seen by the public and also of a further area. The bones in these two areas had been set in rough sand, perhaps with some rubble as a base, and they are still held in place by light mortar. It is clear that they once stood proud as cobbles, but much of their surface has worn almost flat. One area of the floor was made up only of the metapodial bones of cattle, all with their distal ends uppermost; in the other area there were many distal metapodial bones of cattle, but other cattle bones had been used there as well, and also some bones from other species. A few flat stones had also been laid in this area. Most of the bones in both areas of flooring had been set vertically; others were set at an angle, or have slipped out of place, and they are now oblique. A few bones lie loosely to one side. It is not clear from the excavation records whether all of the bones under study were still firmly in place in the floor when they were found, or whether this group, too, included some bones which were loose.

Some of the present material was seen by Dr. Philip Armitage soon after excavation, and at his suggestion two cattle metapodials were submitted to the British Museum laboratories for radio-carbon dating (ref BM -2156 R). First results gave the most likely dates for the death of the animals as from 1675 to 1710; but recent recalibration has altered the possibilites to either 1466 - 1670 or 1755 - 1795, all dates AD. This broader range is less satisfactory as a basis for discussion, but the measurements of the bones may give some indication of their likely provenance from within the calculated time span, and the question is discussed below.

There has been little in the literature on the use of bones in building structures or as decoration. The prehistoric structures made from mammoth bones at Kostenki are a case apart (Grigor'ev 1967). MacGregor (1985,32) cited a 16th century Latin source as recalling an earlier tradition for the use of bones in buildings in bleak northern areas, but for the 17th and 18th centuries he could only refer (ibid, 53) to the work of Armitage, who has now (1989) published a catalogue of the use of bones in architectural features. `Knuckle-bone' floors are the main focus of discussion in his first group, that of bones used in internal decoration (ibid. 202-9): fourteen such floors are listed, most of them on the basis of tradition and of memories, but only two are still extant - a section of floor in a public house at Salisbury and the floor at King John's House. In addition, four knuckle-bone floors are known to have been laid in follies, and three of these are still extant. (It should be said that in this connection the term `knuckle-bone' does not refer to the astragalus but only to the metapodials.)

For the present study Jennie Coy (personal communication) made available her personal photographs and notes on the building known as Whalebone Stores or Knucklebone House at Cley on Sea in Norfolk, where rows of horse, cattle and sheep metapodials and phalanges, with a few horse molars, have been built in regular patterns into an outside wall. The floor at King John's House shows no such regular patterning and it seems to have been laid for practical purposes rather than for decorative effect. Mrs. Sherratt tells of an oral tradition that the room was used for bronze-working and that the floor was laid with bones to guard against any likely splattering of molten metal after accidental contact with stone. The state of the bones casts doubt on this tradition, and the problem is discussed below.

THE METHODS OF STUDY

Each bone was marked with a unique specimen number (MC1...., MT1....). All bones were then carefully examined for cutmarks, and for evidence of erosion, burning or chewing. Pathological anomalies were noted, and a particular watch was kept for any residues from metal-working.

Vernier calipers were used to take the following measurements as described in von den Driesch (1976): SD, minimum breadth of shaft; Bd, greatest breadth at the distal end; BFd and DFd, breadth and depth respectively at the point of fusion of the epiphysis to the diaphysis. In addition, the minimum and maximum depths were taken both of the medial and of the lateral condyle and the breadth of each condyle was measured from the distal end (Figure 1). Where the inner surface of the condyle had been damaged the measurement of its distal breadth was taken by aligning one arm of the calipers along such sound inner surface as remained. All these measurements were recorded correct to 0.1mm.

The cut length of each bone was measured on an osteometric board correct to 1mm.

Data were recorded on a d-Base file constructed for the purpose (FLOORING.DBF), and the archive is available both at the Test Valley Archaeological Trust and at the Faunal Remains Unit.

THE RESULTS

The state of the material

Many bones showed smooth wear on the distal surface like the wear observed in the bones which still stand in the floor, and this wear is discussed in detail below. Apart from the surface floorwear, the state of the material was very good indeed. Of the few bones with signs of erosion, four showed this evenly on all their surfaces (MC37, MT34, MT61, MT66). Within the well-preserved assemblage these bones are so distinctive that they had probably acquired their erosion before they were used for the floor. MT22, by contrast, had a hard clear surface which was marked by pitting on the midshaft; this seemed chemical rather than mechanical, and it is not clear how or at what stage in the use of the bone such marking had occurred.

Though Armitage (1989, 206) describes the floor as having been laid without mortar and held in place by the close packing of the bones, there is evidence of light mortar in the sand and rubble foundation, and two of the metapodials had small concretions of mortar on their surfaces. On the condyles of MT73 the ridges both of the bone and of the mortar had been wearing evenly away. On many other bones a rough powdering of mortar had been trodden into the worn distal end. On MC52 a coating of mortar lay above the smooth worn surface, and Mrs. Sherratt suggests that this came from some loose powder, shifted say by brushing and washing, which had reset itself in dampness; but the process is not readily reversible in this way, and some patching or repairing of the floor may perhaps have been more likely.

The rest of the material was clean, hard and beautifully preserved; one bone in particular (MC 61) had an ivoried sheen.

The eroded MC37 had signs of rodent gnawing on its front surface, and MT45 was also gnawed. There were no signs at all of any chewing by dogs, and such an absence, together with the fine state of preservation on so many of the bones, may suggest the quick use of fresh material for the floor.

A particular watch was kept for any signs of metal. Four metapodials each showed one or two very small, very pale green marks, which were presumably from copper (MC62, MT76, MT77, MT79). Strangely, these marks were on that part of the shaft which had been dug most deeply into the sand - in MT79 they were as far removed as possible from clear signs of floor wear on the distal end. There were no other signs of copper or of bronze, but sixteen metapodials gave small signs of probable rust, mostly in raised brown stains. In four of these (MC52, MC44, MT39, MT48) the rust was on the condyles, and for these it would seem quite possible that small pieces of iron (most likely nails) had been lost on the floor and had been left there for long enough to rust. All the other rustmarks were on the shafts, and there may have been some nails or other iron in the sand into which the material was set. There were no other signs of metals - a professional craftsman in metals, of some 50 years' workshop experience, examined the bones closely and was surprised to find no t race of the treading of small metal fragments into their surface. With such a floor, he did not think that the room could have served as a metal workshop for any serious length of time.

Two bones showed strong signs of burning on the midshaft (MC 44 and MT37), and there was minor midshaft burning on MT40. In addition, MT48 had been burnt on the shaft near the point of distal fusion, and MC10 had small burnt patches both there and at the front of the lateral condyle. These two bones could have been burnt when in position in the floor; but where the burning was deep on the midshaft, this must surely have occurred before the bones were set in the protection of the sand.

Cutmarks

There were light surface cutmarks on 6 metacarpals and on 14 metatarsals. They would seem to have been made with a small sharp blade. Of the light metacarpal cuts, four were on the front surface and two on the back; none was on the distal joint. Of those on the metatarsals, ten were on the front, three were on the back and one was on the distal joint. Most of the cuts were near the point of distal fusion, but some were as high as the midshaft. Some cuts were horizontal, others were oblique. It seems likely that these marks were all from skinning, and their variety may suggest that the bones had come from several sources.

There were also signs of much heavier cutting: all but one of the metapodials had been cut across the shaft, roughly and most likely with a cleaver. Their cut length did not seem to have been important: from the distal end to the furthest point of the midshaft cut they ranged from 96 mm for the smallest metacarpal fragment to 203 mm for the longest metatarsal, and some bones showed repeated false starts at different heights on various sides of the shaft. Many bones had been cut well below the narrowest point of the shaft - there was a metatarsal fragment with a length of only 106mm, for instance, which would needlessly have reduced the amount of material available had this been the first requirement for the floor. There was also variety in the style of the cutting. On some of the bones firm clear blademarks were in evidence, whereas others would seem to have been partly cut through with a strong implement and then broken with force.

But there were some patterns even in these differences, and the midshaft cutting may be seen as a deliberate preparation of the bones for their use in the floor. Whatever the style of their cutting nearly all of the bones had been cut obliquely, some front to back and others side to side, and most had been cut to a point. Since the bones were inverted and stuck in sand, a roughly pointed end would have helped to push them into place and could well have reduced the risk of any rocking when there was movement across the upturned surface. A variety of different lengths would have spread the floor load into the foundations. The single whole bone (MC51) has several abortive cuts (distal, lateral and on the back, and again at the proximal end). No signs of wear were seen on its distal surface and it may be that the failed attempts to cut it led to its rejection for the floor.

Further signs of handling came with some curious forms of damage to the distal surfaces of several of the bones. Sometimes a rough semicircle of bone was missing from one or both of the intercondylar surfaces, and the edge that remained was jagged as though the material had been chipped. Such damage was found on five metacarpal bones (MC17, MC24, MC28, MC34, MC39) and on seven metatarsals (MT8, MT10, MT16, MT33, MT34, MT55, MT63).

At other times a fragment of the distal articular surface - a fragment perhaps 5-10 mm long - had been roughly broken away: seven such marks were found on distal surfaces in the present assemblage (MC3, MC9, MC34, MC 42, MT8, MT11, MT57). It is possible that a few other bones had also been damaged and their evidence lost, since marks on the surface of the distal joint would have been uppermost on inversion and immediately vulnerable to wear. With this caution, however, it should be noted that on only two bones (MC34 and MT8) was there evidence of damage both between the condyles and on their distal surface as well.

The marks, both intercondylar and distal, are similiar to those described and illustrated by Simon Davis (1987) on many bones from a dump of cattle metapodials and phalanges in a 17th/18th century pit in Dorchester, a pit considered likely on various grounds to have been associated with tanning. Davis found marks both on distal metapodials - predominantly on metatarsals - and on the proximal surfaces of the phalanges. He later found similar marks on a metacarpal from the Roman fort at Dodder Hill, and discussed the possible causes more fully (Davis 1990). One suggestion was that the bones had been partly prepared for boneworking and then set aside for further attention; another (quoted as a personal communication from Terry O'Connor) was that the bones had been damaged by some form of clamping as a preliminary to the tanning of the skins.

In contrast to Davis's material, the sample from King John's House showed the same incidence of damage on the metacarpals as the metatarsals (8 out of 64, and 9 out of 79 respectively).

The present marks are not the product of floor wear. They could have come from preparation and cleaning, and would fit with some hard scraping round the inner wall of the condyles before the bones were laid in the floor, perhaps with the jabbing of some sharp implement between the metapodials and their phalanges, and then with heavy levering to remove the last remaining tissues from the bones. Some industrial practice seems quite likely for markings which are distinctive, which are found in a group, and which are closely paralleled in another deposit which is roughly similar in date. Preparation for tanning seems plausible, and it could be that some or all of the present material had come from a tannery - though there is no need to postulate such a source simply from these marks, for bones laid within a house would need to be finely cleaned, and any known techniques of recovery and cleaning could suitably have been applied.

Bones marked roughly in this way would perhaps be surprising in a floor laid first for decoration; but if the main purpose of the bones had been to provide a hard and robust surface such signs of damage would have mattered less.

Floorwear

Nearly all the bones that are still in place in the floor had been heavily worn on their visible surfaces, but in the bones offered for study the signs of floorwear were found in very varying degrees. Eight bones had been worn so flat across the condyles that the distal surface of the joint had been removed (though measurements of breadth could still be taken reliably). Three of these (MC52, MT52, MT78) had been worn straight across as on clean-standing upright bones; four (MC59, MC61, MT60, MT73) had been worn obliquely and had either been laid at an angle or had later slipped from the vertical. The heavy wear in MT79 was also oblique, but this bone had several thick patches of exostosis and the irregularity of its surface may have led to the differential wear.

Thirty-four other bones (20 metacarpals, 14 metatarsals) were worn in a similar way, but on these the patches of flat wear were very much smaller and much of the joint surface still remained. Though many of these bones showed some wear on both condyles, in seven metacarpals and five metatarsals only one side had been affected.

On all these bones the wear was at the distal end. On MT49, by contrast, there were many light scrapes and scratches all in the same direction on the raised medial surface of the front of the bone, and no other suggestions of wear. It is possible that this bone was lying horizontally and that the scratches came from movement backwards and forwards on the protruding edges of the shaft.

There remained one hundred metapodials with no sure signs of floorwear. In view of the massive wear seen on the bones that are still in the floor, this is surprising. Some of the present group of metapodials showed a minimal scuffing or a certain rounding of their distal edges and they may have been in some part of the floor where there was some slight activity, but others are distally so pristine that they must have been very well protected.

THE LIKELY SELECTION OF THE MATERIAL

Selection for species?

The two areas of flooring which remain in place differ in the species represented. One has only cattle bones; the other has also some metapodial bones of horse and of sheep, and the articular ends of all the sheep (or sheep/goat) longbones.

Apart from its cattle metapodials, the assemblage presented for study also contained the humerus shaft of a small horse, with heavy chewing at the proximal end and with signs of chopping at the distal. The bone had been slightly and patchily burnt at the back and there was a very small and pale green stain beneath the trochanter. There was a sheep metatarsal with the distal end worn flat and with mortar in its surface. There were three other sheep metapodials, a metacarpal with light horizontal cuts on the front of its shaft, another with distal chewing, and a broken proximal metatarsal. These had no signs of floor wear, but all four sheep bones came from particularly small individuals - the greatest length of the worn metatarsal could have been no more than 117 mm, which would convert to a withers height of 53 cm, and the smallest breadth of the shaft was only 11.5mm. The chewed metacarpals would have come from sheep of much the same size, and the four bones should probably be taken as a group.

Selection for bone of the body?

The two areas of floor which still remain differ also in their cattle bones, in that the one has only distal metapodials and in the other these are augmented with some proximal metapodials, with several fragments of tibia and of scapula. In the present assemblage a cattle proximal metacarpal, cut at the midshaft, had traces of mortar on the joint surface and had certainly been used for the floor. A chewed femur condyle, by contrast, may have been just a casual find.

More metatarsals had been used than metacarpals (79 to 64). These are generally longer; yet the method of preparation did not make the most of their length. Both on shaft breadth and on distal breadth they would seem less robust than are metacarpals, but in cross-section they are square and perhaps they were thought to pack well together.

Selection for age?

Nearly all the metapodials were fused and would seem to have been selected as being the bones of more mature animals, which presumably were thought to be more rugged. Two unfused shafts (MC8 and MT39) were solid and substantial and had been used in the floor complete with their epiphyses - which again suggests that the bones had been quite fresh when they were laid. MT77 was broken, but was probably unfused; it too was quite substantial. Only MC37 was a small and slender unfused bone; but this had clearly been used in the floor and was flattened by wear.

Selection for condition?

A few bones showed signs of pathological conditions. Three metacarpals had some slight lumpiness or puffiness on the shaft which might have followed a blow (MC6, MC26, MC62); there was lipping on three condyles, again all from the front leg (MC9, MC31, MC63); and three bones of the back leg showed very minor exostoses (MT8, MT62, MT72).

In none of these did the damage seem enough to prejudice the good use of the bone in the floor. MT79, however, was mentioned above for its oblique wear: on this bone the arthropathy had been serious and heavy accretions of exostosis spread over the medial condyle and up the medial side of the shaft to reach 20mm past the level of the foramen; the lateral condyle and lateral side of the shaft were also affected, but less badly so. This exostosis, which must have been painful in life, led to irregular wear in the floor. The condition was so pronounced that it must have been obvious to anyone cleaning and preparing the material, but the bone even so had been used.

Selection for size?

Discussion on size may only be based on such material as remains. Measurements of greatest length are missing save for the one bone that could not be cut (MC51, 204mm). By Fock's (1966,76) factors this would give a withers height of 125.0 cm if the bone came from a male castrate, or of 127.5 cm if, as seems more likely from its rugged proportions, it came from a bull. But the bone is unique in this assemblage, and such a good height may not have been typical.

It may be seen from the tables in the appendix that many even of the midshaft measurements are missing. The distal measurements are therefore all-important. It is fortunate that the bones were not worn as heavily as were so many of those which are still in place in the floor: where there was heavy floor wear in the sample under study, this flattened the ridges of the condyles and part of the condyles themselves but did not go deep enough on the upturned bone to narrow them at their point of greatest breadth. The distal measurements may therefore be taken as reliable.

Comparisons over time may be made with measurements of cattle from Southampton, which is only some 12 km from Romsey and which seems to have drawn its animals from a wide area. A large sample of cattle bones from Middle Saxon Hamwic, and smaller samples from later periods in Southampton, have established a broad trend of quite good-sized cattle in the Middle Saxon period there, followed by a decline in sizes perhaps in Late Saxon and certainly in early Norman times, and a marked recovery in the later medieval period (Bourdillon 1980, 186). Other work has suggested that such trends may have been common to a wider area of Wessex (Coy 1980, 147, Coy 1984); and Armitage (1980 and 1982, 105) found evidence of new, large longhorned cattle in 14th to

16th century contexts in the City of London. The measurements of the Romsey medieval cattle (Bourdillon in preparation) would seem to fit this pattern of early medieval decline and of later medieval recovery. As yet there are few cattle measurements from postmedieval sites in the town with which the present material may be compared, but there are good comparisons to be made with Davis's (1987) assemblage of cattle foot bones from a 17th/18th century pit in Dorchester.

The radio-carbon results would seem to allow a broad span of possible dates, the most likely being between 1460 - 1670 or 1755 - 1795. The histograms of measurements in Figures 2 and 3 show that the material from King John's House is far closer to that from 17th/18th century Dorchester than to that from 15th/16th century Southampton. On the size of the cattle bones, then, some date in the 17th or 18th centuries is to be preferred (though one notes that on the present calibrations the period from 1670 to 1755 is no longer on offer). It is of interest that the few sheep bones found in association with the floor were so small and slender; they are likely to come from stock unaffected by the major improvements to sheep in the later 18th century, which might argue for a somewhat earlier date for the group as a whole.

Any rigid selection for size in the King John's House material would seem to be precluded by the broad range of the measurements as summarised in Table 1. Some bones indeed were from large individuals; but there were also the bones of several small ones, and a range of 20mm is considerable where the mean is barely 60mm (for the breadth at the point of distal fusion on the metacarpus). So too is a range of nearly 24mm for the metacarpal distal breadth.

The coefficients of variation make the point more strongly. These figures are quite high for the metacarpals, and this confirms a general variation within the wide measurement range. The metatarsals show less variation, but this is not unusual (e.g. Fock 1966,75) and may be that the need to support the unborn calf calls for extra strength in the back legs of a cow, a strength which would go some way to modify the common size differentiation of male and female bones. For the metacarpal breadth at the point of distal fusion, the King John's assemblage has an exact correspondence with the coefficient of variation from Hamwic - and indeed with that from the Dorchester pit.

TABLE 1: SOME METAPODIAL MEASUREMENTS COMPARED

(i) cattle metacarpus, breadth at point of distal fusion

	x	range	S	CV	n
Hamwic main phase	53.0	44.5 - 65.5	4.6	8.7	117
Southampton C11/12th	49.9	41.7 - 58.0	6.0	12.0	10
Southampton C15/16th	53.0	44.7 - 63.7	5.5	10.4	13
King John's House	58.9	49.1 - 69.6	5.2	8.7	60
Dorchester pit	60.0	50.5 - 69.5	5.2	8.7	37

(ii) cattle metacarpus, greatest distal breadth (Bd)

	x	range	S	CV	n
Hamwic main phase	57.8	45.5 - 71.8	5.8	10.0	130
Southampton C11/12th	54.0	46.3 - 63.7	6.6	12.2	13
Southampton C15/16th	56.7	47.7 - 68.0	5.0	8.8	25
King John's House	62.6	52.6 - 76.4	6.2	10.1	60
Dorchester pit	63.8	56.0 - 77.0	6.0	9.3	37

(iii) cattle metatarsus, breadth at point of distal fusion

	x	range	S	CV	n
Hamwic main phase	51.3	43.5 - 59.3	3.8	7.4	37
King John's House	56.5	47.2 - 65.1	4.6	8.2	74
Dorchester pit	55.7	46.3 - 64.3	4.9	8.8	38

(iv) cattle metatarsus, greatest distal breadth (Bd)

	x	range	S	CV	n
Hamwic main phase	53.8	42.6 - 63.6	4.6	8.5	80
Southampton C11/12th	46.7	42.1 - 54.1	4.3	9.3	12
Southampton C15/16th	52.3	44.4 - 62.8	7.3	13.9	10
King John's House	58.3	48.8 - 68.7	5.0	8.8	74
Dorchester pit	57.7	50.0 - 70.5	5.1	8.9	36

But whilst there is a similar amount of variation at Hamwic and at King John's House, it need not follow that the pattern of variation is the same: Figures 2 and 3 suggest that the material from the floor at King John's House may have included a few more male metacarpals and many more male metatarsals than were found, relatively, in the general rubbish deposition at Hamwic.

For a more precise metrical study of the likely sex of the animals, the absence of measurements of greatest length made it impossible to plot Fock's index of distal breadth divided by greatest length against the distal breadth itself (Fock 1966, 90, diagram 8): when this had been done for the Hamwic material it had given a clear preponderance of cows (Bourdillon and Coy 1980,108), an interpretation which was later confirmed by metrical studies on other bones of the body. Coy (1984) has usefully plotted the greatest distal breadth against the breadth at the point of distal fusion for material from Winchester. When the corresponding data were plotted for the present material there were two metacarpals (MC11 and MC63) which stood some away apart, a sign of splaying and perhaps of the use of these animals for traction; but there was no convincing separation into male and female groups (Figure 4). Similar data for the metatarsals were plotted as a check (Figure 5). One strange splayed metatarsal stood apart (MT49) but no sexing groups were seen. Davis found general homogeneity in his Dorchester pit and interpreted his material as coming largely or exclusively from cows; but the needs of strong and heavy bones for flooring would make that most unlikely here.

Thomas (in press) has recently examined many metapodial measurements in archaeological material (in particular from cattle metacarpal bones from Saxon Southampton) and also from known modern specimens, to check for correlation of bone shape and sex. He has found that the best separation came in plotting the breadth of the medial condyle of the metacarpus against the breadth of its lateral condyle. For this, and only for this, he found that separation was distinct.

This method gave quite promising results for the present material, though the results were less clear-cut than had been found in Thomas's work: in Figure 6, where the breadth of the two distal condyles of the metacarpus are set against each other, the the concentration in the lower left hand corner of the graph would have been of bones from female animals and perhaps just over thirty specimens come into this group. The rest of the material clusters more roughly, but many of these bones are likely to have been from males. If this is so, it would bear out the first indications from the histograms, and might suggest either more castration and the wider use of the animals for traction, or else some preference of male bones as the good heavy material for a floor. There is no reason to think that traction was more common at Romsey than in the general period elsewhere: it is more likely that where there had been any choice it was the larger and the stronger bones that had been taken for flooring, abd bulls and oxen then may be represented in the present material more highly than they were in the adult herds. But many bones from cows were used as well, and some of these bones were small.

The floor required a great deal of material, and selection for sex - as for species - was no more than partial.

REFERENCES

Armitage P L 1980 A preliminary description of British cattle from the late twelfth to the early sixteenth century, Ark 7 (12), 405-15.

Armitage P L 1982 Studies on the remains of domestic livestock from Roman, medieval, and early modern London: objectives and methods. In Environmental Archaeology in the urban context (A R Hall and H K Kenward, eds.), CBA research report 43.

Armitage P L 1989 Gazeteer of sites with animal bones used as building material. In Diet and Crafts in Towns, D. Serjeantson and T Waldron (eds), British Archaeological Reports British Series 199, 201-223.

Bourdillon J and Coy J 1980 The animal bones. In Excavations at Melbourne Street, Southampton, 1971-6, P. Holdsworth (ed.), CBA research report 33, 79-121.

Bourdillon J 1980 Town life and animal husbandry in the Southampton area, as suggested by the excavated bones. Proc. Hants. Field Club and Archaeolog. Soc., 36, 181-191.

Coy J 1980 The animal bones. In J Haslam, A Middle Saxon iron smelting site at Ramsbury, Wiltshire. Medieval Archaeology 24, 41-51.

Coy J 1984 Animal bones from Saxon, medieval and post-medieval phases (10-18) of Winchester Western suburbs. Report to the Ancient Monuments Laboratory, no. 4910.

Davis S J M 1987 Cattle foot bones excavated in 1982 from a seventeenth/eighteenth century pit in Church Street, Dorchester, Dorset. Report to the Ancient Monuments Laboratory, no. 222/87.

Davis S J M 1990 (for 1988) Some peculiarly damaged cattle metapodials. Circaea, 6, 2, 115-119.

Driesch A von den 1976 A guide to the measurement of animal bones from archaeological sites. Harvard: Peabody Museum of Archaeology and Ethnology.

Fock J 1966 Metrische Untersuchungen an Metapodien einiger europaischer Rinderassen. Inaugural dissertation, University of Munich.

Grigor'ev G P 1967 A new reconstruction of the above-ground dwelling of Kostenki. Current Anthropology 8, 4, 344-8.

MacGregor A 1985 Bone Antler Ivory and Horn: the technology of skeletal material since the Roman period. London: Croom Helm.

Thomas, R N W (in press) A statistical evaluation of criteria used in sexing cattle metapodia, Archaeozoologia 5.

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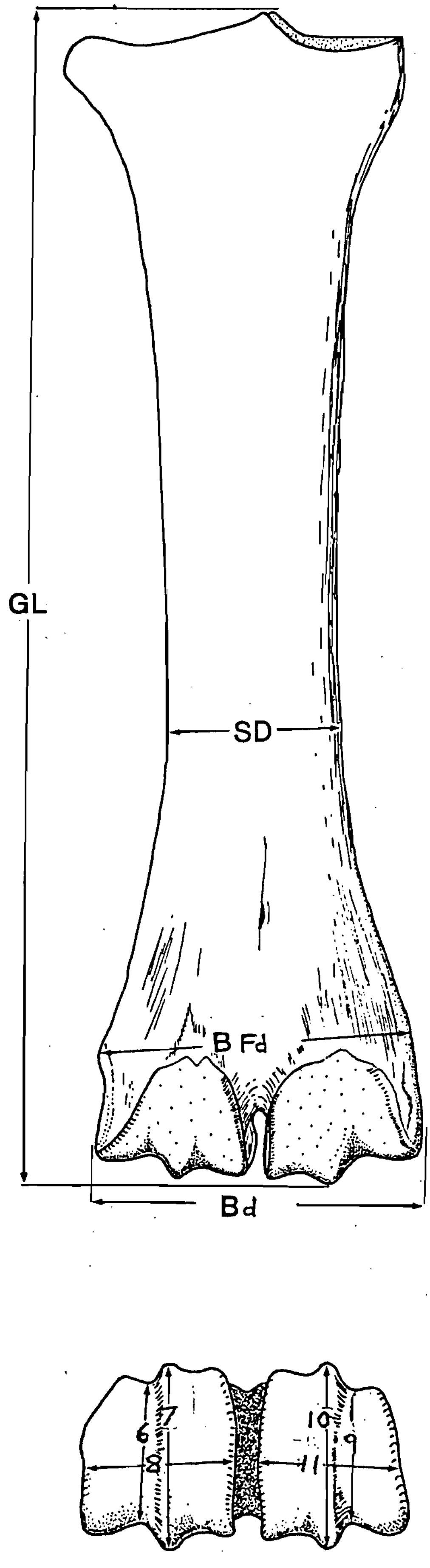
FIGURE 1
THE LOCATION OF THE MEASUREMENTS



the numbers on the condyles refer to the columns in the appendix tables

FIGURE 2

CATTLE METACARPALS, MEASUREMENTS OF DISTAL BREADTH
(Bd, in mm)

```
HAMWIC
C8th
-----------------------------------------------
                   *
24                ****
                  ****
                  ****  **   **
12                **** **** ****
                  **** **** ****
             ***  **** **** **** ***   **
-----------------------------------------------

SOUTHAMPTON
CC12/13th
-----------------------------------------------
              **
4            ****  **   *   ****
-----------------------------------------------

SOUTHAMPTON
CC15/16th
-----------------------------------------------
                        **
8                 ***  ****   *
             ***  **** **** ****  **
-----------------------------------------------

KING JOHN'S
HOUSE
-----------------------------------------------
24                     ****
                       ****
                       ****      ***
12                     ****  **  ****
                   *   **** **** ****  *
                  **** **** **** **** ****  **
-----------------------------------------------

DORCHESTER
CC17th/18th
-----------------------------------------------
                             **
12                     **** ****
                       **** ****  *         .
                       **** **** **** **** ***'
-----------------------------------------------
             45-  50-  55-  60-  65-  70-  75-
             49.9 54.9 59.9 64.9 69.9 74.9 79.9
===============================================
*  each dot represents one measurement
   in the relevant group
```

FIGURE 3

CATTLE METATARSALS, MEASUREMENTS OF DISTAL BREADTH (Bd, in mm)

```
HAMWIC
C8th
-----------------------------------------------
                             **
12                 *    *   ****
                  **** **** ****
                  **** **** ****  *
-----------------------------------------------

SOUTHAMPTON
CC12/13th
-----------------------------------------------
              *
4            **** **** ***
-----------------------------------------------

SOUTHAMPTON
CC15th/16th
-----------------------------------------------
4             *   ****  *    *   ***
-----------------------------------------------

KING JOHN'S
HOUSE
-----------------------------------------------
24                      *        ****
                       **** **** ****
                       **** **** ****
12                     **** **** ****
                       **** **** **** ***
                   *   **** **** **** ****
-----------------------------------------------

DORCHESTER
CC17th/18th
                        **
12                     **** ***
                       **** **** ***
                       **** **** **** ***  *
-----------------------------------------------
             40-  45-  50-  55-  60-  65-  70-
             44.9 49.9 54.9 59.9 64.9 69.9 74.9
===============================================
```

* each dot represents one measurement in the relevant group

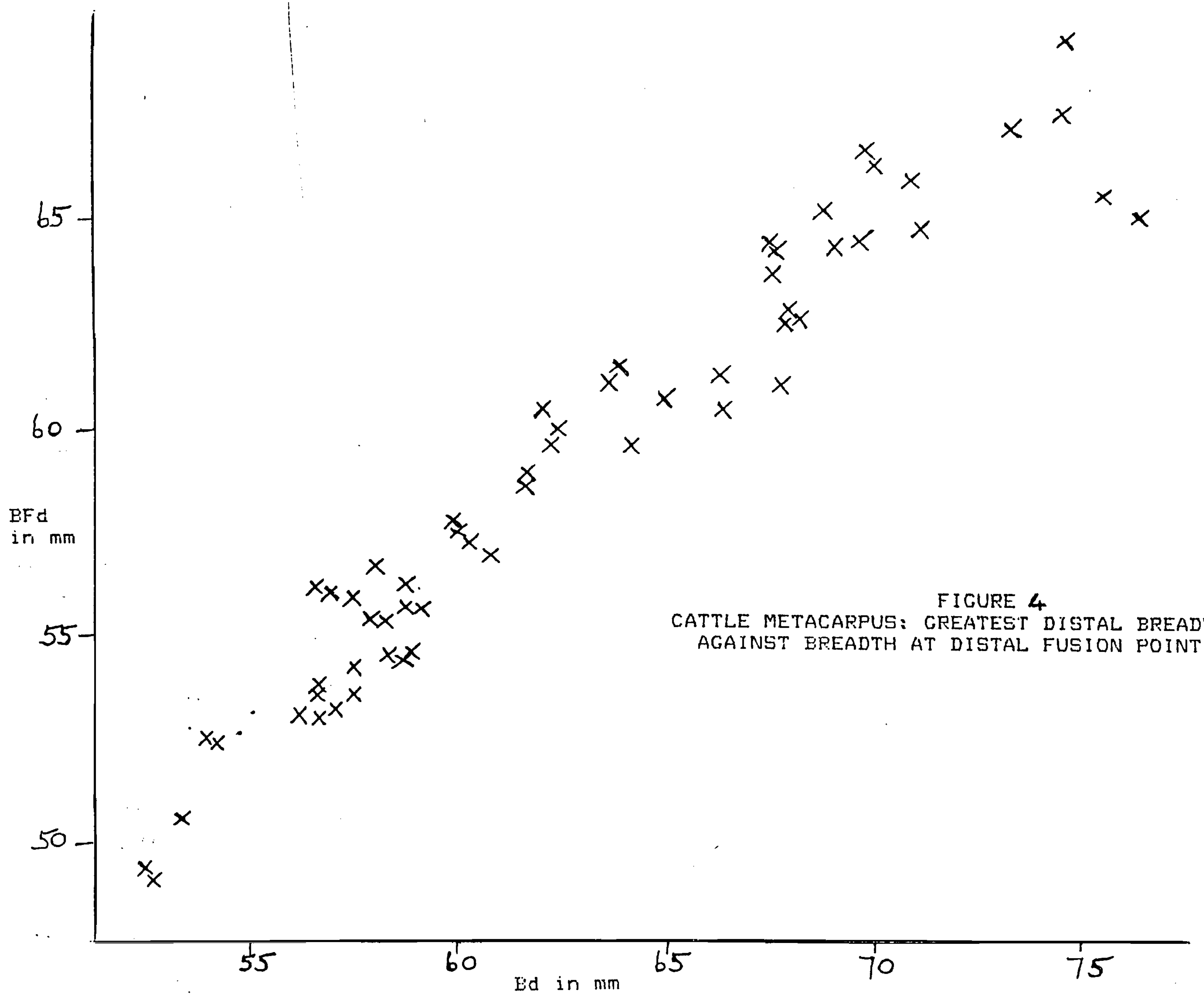


FIGURE 4
CATTLE METACARPUS: GREATEST DISTAL BREADTH (Bd)
AGAINST BREADTH AT DISTAL FUSION POINT (BFd)

FIGURE 5

CATTLE METATARSUS: GREATEST DISTAL BREADTH (Bd) AGAINST BREADTH AT DISTAL FUSION POINT (BFd)

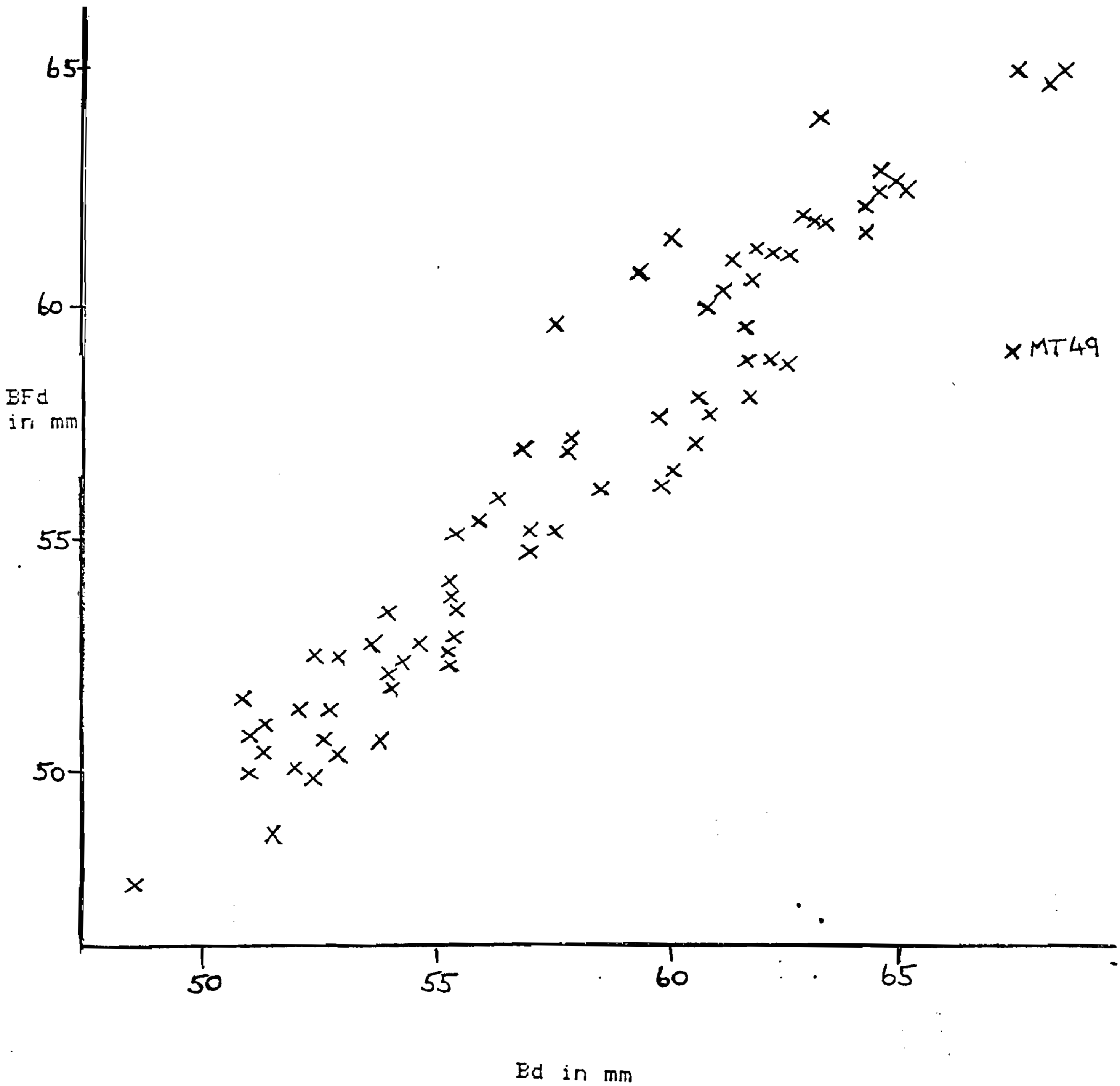
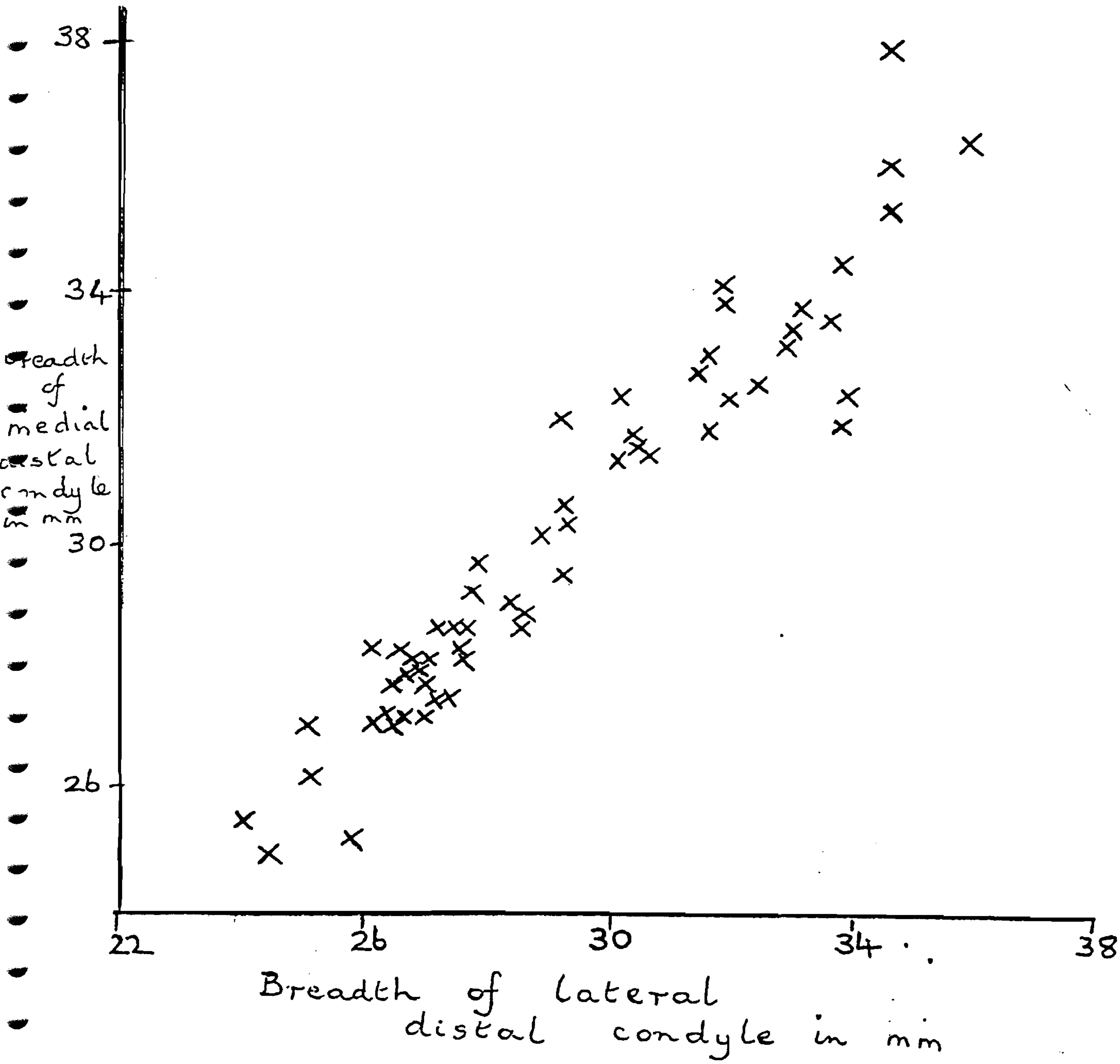


FIGURE 6
CATTLE METACARPUS: BREADTH OF LATERAL DISTAL CONDYLE AGAINST BREADTH OF MEDIAL DISTAL CONDYLE



APPENDIX TABLE 1 - MEASUREMENTS OF METACARPUS in mm

		MST1	MST2	MST3	MST4	MST5	MST6	MST7	MST8	MST9	MST10	MST11
MC01	R	133.0	43.0	61.2	32.3	66.3	27.7	34.2	31.5	26.2	34.2	30.1
MC02	L	147.0	36.3	58.5	31.4	61.6	26.9	35.0	30.2	23.8	34.4	28.9
MC03	R	131.0	34.3	53.4	29.2	56.5	24.1	31.0	27.2	22.6	30.2	26.2
MC04	L	139.0	35.1	55.6	32.0	58.9	25.9	32.2	28.3	23.6	31.5	27.6
MC05	R	131.0	38.6	61.1	31.3	63.5	28.1	34.2	30.4	24.1	33.6	29.3
MC06	L	146.0	0.0	57.3	29.5	60.6	28.0	32.6	29.1	24.7	31.6	28.4
MC07	R	137.0	32.2	55.3	29.5	57.7	26.1	32.0	28.0	24.7	30.7	26.8
MC08	L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MC09	L	130.0	0.0	59.6	32.2	64.1	28.0	33.3	32.1	26.6	33.1	29.2
MC10	L	125.0	35.2	56.1	29.8	55.8	27.4	32.2	27.6	24.3	31.0	27.4
MC11	L	126.0	0.0	65.2	31.0	76.4	30.9	37.5	35.7	28.4	35.4	35.9
MC12	L	157.0	0.0	58.9	30.1	61.5	27.1	32.8	28.8	24.8	31.7	28.5
MC13	L	130.0	0.0	63.8	33.2	67.5	29.3	34.4	33.2	25.6	34.0	31.6
MC14	L	119.0	37.5	64.3	31.0	67.5	28.0	35.0	32.4	25.2	33.5	31.9
MC15	R	158.0	41.8	67.1	34.6	72.9	31.8	37.7	35.5	28.9	37.9	34.5
MC16	R	146.0	42.1	62.6	31.5	67.8	28.5	34.3	32.7	25.6	33.7	32.4
MC17	L	148.0	0.0	62.7	35.3	68.0	29.9	36.1	31.8	27.0	35.7	30.3
MC18	R	143.0	32.9	55.4	28.7	57.5	24.9	31.9	27.5	24.4	31.5	27.2
MC19	L	160.0	36.6	60.7	32.9	64.9	30.4	36.3	31.6	27.6	35.9	30.5
MC20	L	133.0	0.0	54.4	29.0	58.9	25.6	30.3	28.7	23.6	30.9	27.7
MC21	L	111.0	0.0	49.2	27.8	52.5	24.4	30.1	25.6	21.4	29.8	24.1
MC22	R	123.0	0.0	64.3	34.3	69.0	29.1	35.5	33.9	27.0	34.7	33.0
MC23	L	119.0	0.0	64.5	32.0	67.3	27.1	31.8	31.9	24.7	32.3	31.5
MC24	L	142.0	41.5	63.6	34.2	67.8	31.7	37.0	32.9	28.3	34.8	31.4
MC25	R	128.0	33.9	56.3	29.6	58.7	25.7	33.4	28.3	24.4	31.6	27.6
MC26	R	128.0	0.0	67.5	33.8	74.3	31.7	39.3	36.2	29.1	36.3	34.5
MC27	L	195.0	0.0	69.6	33.3	74.4	31.1	37.6	34.6	27.4	36.6	33.7
MC28	L	149.0	0.0	57.7	30.9	59.9	26.1	32.9	28.4	23.8	32.0	26.2
MC29	L	132.0	29.1	49.1	26.3	52.6	22.1	28.4	25.0	20.8	28.5	24.5
MC30	R	141.0	0.0	65.1	30.6	69.4	28.5	33.3	32.5	24.8	32.8	33.7
MC31	R	174.0	0.0	60.9	32.7	67.6	28.2	33.2	32.0	23.9	32.4	33.8
MC32	R	105.0	0.0	54.3	29.6	58.8	25.5	31.5	28.7	23.3	31.2	27.2
MC33	R	152.0	0.0	51.7	28.9	56.9	25.8	32.2	27.8	23.5	30.8	27.0
MC34	L	151.0	33.5	56.2	29.6	56.1	26.9	31.5	27.2	22.9	30.9	25.2
MC35	L	141.0	0.0	66.7	33.0	69.5	30.2	36.5	34.0	26.0	35.3	31.8
MC36	R	158.0	40.9	64.5	34.1	63.5	28.3	36.8	34.2	26.8	35.3	31.7
MC37	L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MC38	L	134.0	0.0	56.9	28.8	59.0	26.8	33.2	28.3	24.1	31.8	26.7
MC39	L	141.0	0.0	64.8	32.1	70.8	30.4	37.0	33.5	27.9	35.5	32.9
MC40	R	140.0	0.0	54.3	28.9	59.1	26.8	33.6	28.2	25.4	31.9	26.8
MC41	L	126.0	0.0	59.9	30.6	62.2	27.8	32.7	29.6	23.6	31.6	29.3
MC42	L	140.0	35.5	61.4	30.2	63.7	28.3	34.0	30.7	24.8	31.7	29.3
MC43	L	126.0	0.0	53.4	28.7	56.5	24.4	30.7	27.2	23.3	30.8	26.6
MC44	R	154.0	0.0	59.6	29.2	59.8	26.4	34.2	29.0	25.5	33.2	28.5
MC45	L	140.0	34.3	55.7	30.8	58.2	25.7	32.1	28.2	22.9	31.4	27.1
MC46	R	167.0	36.7	60.5	31.0	65.2	30.9	37.8	32.5	27.6	35.5	30.1
MC47	R	136.0	31.1	53.4	30.5	57.5	26.0	33.5	28.1	24.9	32.7	26.9
MC48	R	125.0	0.0	54.2	33.1	57.4	25.3	31.8	27.3	22.7	31.4	26.4
MC49	R	175.0	39.5	66.0	34.2	70.7	31.5	37.1	33.7	30.4	36.1	33.5
MC50	R	139.0	0.0	66.4	33.0	69.7	30.5	35.8	33.3	27.8	34.5	32.8
MC51	R	0.0	38.2	60.2	30.9	61.8	26.1	30.3	29.8	24.9	31.7	27.9
MC52	L	96.0	0.0	55.9	29.1	57.3	25.5	31.6	27.3	23.3	31.0	26.8
MC53	R	165.0	35.2	57.0	30.9	60.9	27.7	33.1	28.7	25.1	29.1	27.5
MC54	L	180.0	31.4	53.2	31.0	57.3	26.5	33.5	27.9	23.1	32.5	26.6

MEASUREMENTS OF METACARPUS. continued

		MST1	MST2	MST3	MST4	MST5	MST6	MST7	MST8	MST9	MST10	MST11
MC55	L	114.0	34.9	57.6	32.7	59.8	26.8	34.8	29.3	24.9	34.1	27.7
MC56	L	152.0	32.0	52.3	28.4	54.1	25.4	30.6	26.9	22.7	29.2	26.2
MC57	L	149.0	0.0	52.9	30.2	56.7	25.3	32.0	27.3	22.5	31.1	27.0
MC58	R	172.0	39.6	62.4	32.3	65.5	29.1	35.6	31.6	26.4	34.1	30.6
MC59	R	108.0	0.0	53.0	29.2	56.1	0.0	0.0	0.0	0.0	0.0	0.0
MC60	L	125.0	30.1	50.6	29.7	53.5	24.9	30.9	25.9	22.6	30.1	25.3
MC61	R	139.0	32.5	52.3	29.4	54.0	0.0	0.0	0.0	0.0	0.0	0.0
MC62	F	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MC63	L	128.0	42.8	65.8	34.7	75.4	29.2	0.0	38.1	27.5	34.5	34.5
MC64	L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEAN		140.3	36.0	58.9	31.0	62.5	27.5	33.6	30.3	25.1	32.7	29.2
MIN		96.0	29.1	49.1	26.3	52.6	22.1	28.7	25.0	20.6	28.5	24.1
MAX		195.0	43.0	69.6	35.3	75.4	31.8	38.3	38.1	30.4	37.9	35.9
n		59	31	60	60	60	58	57	58	58	58	58

Key:

MST1	cut length	
MST2	smallest breadth diaphysis	SD (von den Driesch)
MST3	greatest breadth distal end	Bd
MST4	breadth at distal fusion point	BFd
MST5	depth at distal fusion point	DFd
MST6	minimum depth medial distal condyle	
MST7	maximum depth medial distal condyle	
MST8	breadth medial distal condyle	
MST9	minimum depth lateral distal condyle	
MST10	maximum depth lateral distal condyle	
MST11	breadth lateral distal condyle	

APPENDIX TABLE 2 - MEASUREMENTS OF METATARSUS in mm

		MST1	MST2	MST3	MST4	MST5	MST6	MST7	MST8	MST9	MST10	MST11
MT01	L	174.0	31.7	61.8	31.7	63.5	27.8	35.1	31.0	24.6	33.5	28.2
MT02	R	181.0	35.0	62.2	34.6	65.9	30.7	36.8	34.7	27.8	35.9	29.8
MT03	L	182.0	32.3	59.7	34.1	61.5	27.2	34.4	29.9	25.2	33.4	29.2
MT04	R	187.0	27.3	50.5	30.7	53.0	25.3	32.9	24.9	23.3	31.7	23.9
MT05	L	124.0	0.0	65.1	35.6	68.7	30.8	37.4	32.8	28.1	35.9	31.4
MT06	L	187.0	34.7	62.8	33.0	64.6	29.7	34.0	30.1	27.0	32.4	29.4
MT07	R	122.0	0.0	59.9	33.7	60.9	27.8	35.1	29.0	26.0	35.0	28.8
MT08	R	199.0	33.7	62.7	31.8	65.0	27.9	36.7	30.3	26.3	35.8	30.2
MT09	R	151.0	24.6	47.2	26.6	48.8	23.6	30.5	23.3	21.4	29.8	21.3
MT10	R	157.0	31.0	56.9	31.8	57.9	26.5	34.9	27.6	25.6	34.3	27.7
MT11	R	145.0	29.0	52.9	32.4	55.4	25.6	31.8	26.8	24.0	32.3	25.6
MT12	L	193.0	27.9	50.7	30.1	53.8	24.0	32.5	25.5	22.5	31.3	24.8
MT13	L	182.0	31.1	56.5	31.5	60.1	25.4	31.9	28.5	22.9	31.2	28.4
MT14	R	163.0	32.0	57.7	31.0	60.9	26.9	34.2	29.4	24.9	33.2	28.3
MT15	R	193.0	26.7	50.7	28.2	52.7	23.5	30.7	24.9	22.3	29.5	24.0
MT16	L	170.0	27.2	51.4	29.0	52.3	0.0	0.0	0.0	0.0	0.0	0.0
MT17	L	156.0	0.0	53.5	30.8	53.7	25.9	33.7	26.6	23.4	32.2	25.3
MT18	L	175.0	31.9	59.7	30.8	57.6	26.0	33.1	28.0	23.2	32.2	27.2
MT19	L	173.0	27.3	52.0	28.8	54.1	26.3	31.9	26.4	23.6	31.8	24.5
MT20	L	166.0	32.5	58.8	31.8	61.9	27.4	35.5	29.6	24.9	34.1	28.4
MT21	L	155.0	0.0	51.7	30.3	50.9	24.6	30.3	24.1	22.3	30.7	22.5
MT22	R	184.0	32.6	60.7	33.5	59.5	28.0	34.8	27.9	26.4	34.1	27.5
MT23	L	185.0	0.0	58.8	30.5	62.6	26.7	34.3	30.9	23.9	33.3	27.6
MT24	R	184.0	31.9	54.0	28.4	55.3	25.8	32.0	25.8	24.1	30.9	25.3
MT25	R	167.0	0.0	52.5	31.1	55.3	26.2	34.3	26.6	24.3	32.5	25.4
MT26	R	131.0	0.0	52.8	31.5	54.6	25.9	33.2	25.8	24.2	32.4	25.1
MT27	R	173.0	28.9	51.9	28.9	54.2	24.9	32.4	25.1	22.6	31.4	23.2
MT28	L	125.0	0.0	48.8	28.6	51.7	24.0	30.5	24.8	22.6	29.9	23.7
MT29	L	184.0	28.4	55.4	31.2	56.0	25.3	30.5	25.5	23.5	29.2	25.9
MT30	R	191.0	0.0	65.1	32.8	67.7	28.8	36.1	31.8	25.8	36.5	30.4
MT31	R	203.0	29.3	52.4	31.4	55.3	25.6	33.3	26.1	24.1	32.3	25.5
MT32	R	158.0	0.0	61.3	32.9	62.7	28.4	37.0	30.1	25.6	35.4	28.6
MT33	L	176.0	0.0	61.3	33.8	62.0	29.2	35.1	29.3	28.0	34.7	28.5
MT34	L	193.0	31.3	60.6	0.0	61.8	0.0	0.0	0.0	0.0	0.0	0.0
MT35	L	189.0	27.4	52.5	31.7	52.5	26.0	32.4	25.5	23.7	32.6	24.7
MT36	R	183.0	27.4	49.8	31.1	52.3	25.5	33.3	25.1	24.0	32.6	25.6
MT37	R	183.0	29.8	55.1	29.6	55.4	25.6	32.9	26.6	24.3	32.2	26.0
MT38	R	145.0	29.8	55.2	32.4	58.7	26.6	34.2	29.3	24.3	33.8	27.1
MT39	R	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT40	R	172.0	31.7	54.8	29.0	57.1	24.1	30.2	26.8	21.9	29.3	25.9
MT41	R	180.0	26.9	49.9	28.2	51.2	22.9	30.5	24.9	20.9	29.2	23.6
MT42	R	159.0	0.0	50.3	29.0	51.2	24.9	31.4	24.7	23.9	31.2	23.5
MT43	L	199.0	32.4	57.6	32.4	59.9	27.0	33.6	28.3	24.7	33.6	28.2
MT44	L	191.0	31.5	62.4	33.5	64.6	28.4	36.3	31.2	25.7	35.1	28.1
MT45	L	179.0	27.4	55.8	31.1	56.3	26.9	34.5	27.0	24.9	33.9	25.9
MT46	L	155.0	0.0	58.0	32.3	61.8	27.1	34.8	30.2	24.7	34.1	28.4
MT47	R	148.0	0.0	52.4	30.5	54.2	25.1	33.3	26.5	22.9	31.9	24.4
MT48	R	176.0	34.1	62.7	33.3	65.2	28.2	36.1	30.7	25.8	35.1	30.5
MT49	L	188.0	0.0	59.2	36.1	67.5	28.4	36.8	34.2	26.4	34.2	30.8
MT50	L	178.0	31.7	55.2	30.4	57.3	27.5	33.8	26.8	25.5	33.6	25.9
MT51	R	135.0	0.0	53.5	31.6	55.7	26.6	32.8	26.4	24.4	32.2	25.9
MT52	L	106.0	0.0	52.8	31.0	53.3	26.4	32.5	26.0	22.7	32.0	24.0
MT53	R	160.0	29.5	53.7	29.5	55.6	25.9	33.2	26.6	24.5	32.2	25.9
MT54	L	177.0	0.0	52.5	29.2	53.0	25.8	32.2	25.1	24.0	30.5	24.7

MEASUREMENTS OF METATARSUS, continued

	MST1	MST2	MST3	MST4	MST5	MST6	MST7	MST8	MST9	MST10	MST11
MT55 R	177.0	0.0	61.0	31.4	61.3	27.7	34.0	29.8	24.8	33.4	27.7
MT56 L	0.0	27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT57 R	142.0	32.8	57.9	33.9	62.5	27.6	36.2	29.5	25.8	35.6	28.1
MT58 R	194.0	32.7	57.1	32.9	57.9	26.9	34.5	27.4	25.0	33.7	27.0
MT59 R	180.0	34.8	61.1	32.5	62.4	28.9	34.3	29.4	27.2	34.1	28.2
MT60 R	185.0	34.3	61.9	34.1	63.0	28.2	35.1	30.6	25.8	33.8	29.6
MT61 R	174.0	33.5	63.7	28.9	62.2	0.0	0.0	0.0	0.0	0.0	0.0
MT62 L	177.0	31.0	58.2	32.2	61.5	28.0	32.7	29.8	26.1	32.1	28.6
MT63 R	185.0	30.0	58.0	33.0	60.8	27.9	33.2	28.0	24.8	33.3	25.9
MT64 R	172.0	30.0	55.2	30.6	56.7	25.3	32.5	27.3	24.7	32.1	25.9
MT65 R	121.0	0.0	50.4	27.4	51.3	23.8	30.0	25.2	21.1	28.1	22.7
MT66 L	188.0	25.8	51.0	0.0	51.1	23.7	29.6	24.3	22.0	27.5	23.3
MT67 L	187.0	29.1	56.2	31.5	59.9	27.6	35.4	28.2	25.0	34.7	27.5
MT68 L	188.0	36.6	64.9	36.9	68.4	30.6	38.6	33.1	27.7	37.4	32.0
MT69 L	188.0	34.2	61.6	33.4	64.2	28.5	34.0	31.0	25.5	34.4	29.5
MT70 L	180.0	31.7	57.1	30.9	60.7	26.4	32.8	29.0	23.4	32.1	28.0
MT71 L	187.0	30.7	55.7	30.9	57.0	27.0	33.7	27.1	24.4	31.8	26.7
MT72 R	140.0	0.0	61.4	34.6	60.1	27.0	35.1	28.8	26.2	35.1	28.1
MT73 R	181.0	35.2	63.8	35.3	61.2	26.1	34.3	27.5	24.7	34.2	31.3
MT74 L	121.0	28.1	51.4	30.4	52.8	24.0	31.4	25.5	21.4	30.5	24.4
MT75 R	184.0	34.4	61.8	33.9	63.3	28.4	35.3	30.1	25.8	34.6	28.9
MT76 R	150.0	29.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT77 L	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MT78 L	154.0	27.7	50.3	28.4	51.9	23.8	30.9	24.4	22.6	30.3	23.8
MT79 L	142.0	28.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MEAN	169.7	30.6	56.5	31.4	59.3	26.0	33.5	27.0	24.5	32.7	26.7
MIN	106.0	24.6	47.2	26.6	48.8	22.9	29.6	23.2	20.9	27.5	21.3
MAX	203.0	35.2	65.1	35.6	68.7	30.8	38.6	34.7	28.1	37.4	32.0
n	76	56	74	72	74	71	71	71	71	71	71

key:

MST1	cut length	
MST2	smallest breadth diaphysis	SD (von den Driesch)
MST3	breadth at distal fusion point	BFd
MST4	depth at distal fusion point	DFd
MST5	greatest breadth distal end	Bd
MST6	minimum depth medial distal condyle	
MST7	maximum depth medial distal condyle	
MST8	breadth medial distal condyle	
MST9	minimum depth lateral distal condyle	
MST10	maximum depth lateral distal condyle	
MST11	breadth lateral distal condyle	